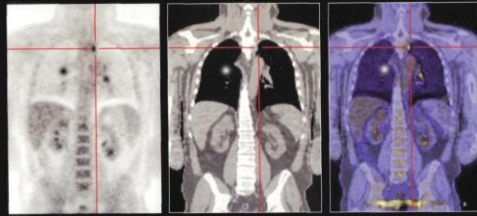


The PET/CT Training Institute



Advancing the Science of Molecular Imaging

45 HR PET/CT REGISTRY REVIEW COURSE

Course Control Document

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The PET/CT Training Institute, Inc.

SNMMI-TS 028600-028632 45hr CEH's Voice Credits

45 Hr PET Registry Review Course

Module I: Introduction to Positron Emission Tomography

TOPIC: **Syllabus Review**

TOPIC: **Pretest**

TOPIC: Lecture: **MIWIQI: 028600: "Historical Origins of Nuclear Medicine and PET"**:

Objectives: **.5 CEH**

1. Explain the origin of Positron Emission Tomography and the people who help make it happen.
2. List the benefits of PET/CT in the clinical practice of medicine.

TOPIC: Lecture: **MIWIQII: 028601: "Nuclear Decay Mathematics"**:

Objectives: **1.0 CEH**

3. Explain how to use the TI 30IIXS calculator for Nuclear Mathematics
4. Apply the calculator in solving radioactive decay equations.
5. Review basic mathematics of Radioactive Decay, Pre-Calibration, Post Calibration using the TI30XIIA calculator

TOPIC: Lecture: **MIWIIQI: 028602: “Background Radiation”**:

Objective: **1.5 CEH**

1. Discuss sources of ionizing radiation.
2. Review the various radioisotopes in the PET department.
3. MIWIEI: EXAM I:

TOPIC: Lecture: **MIWIIQI: 028603: “Atomic Structure and Nuclear Stability”**

Objectives: **1.5 CEH**

1. Describe the properties of electromagnetic and particulate radiations.
2. Describe the structure of an atom, and its components and properties.

TOPIC: Lecture: **MIWIIQI: 028604: “Alpha and Beta Decay”**

Objectives: **1.5 CEH**

1. List the nuclear families and state their characteristics.
2. Write the correct form of radionuclide notation.
3. MIWIEII: EXAM II:

TOPIC: Lecture: **MIWIIQI: 028605: “Gamma Decay , Positron Decay and Electron Capture”**

Objectives: **1.5 CEH**

1. Explain annihilation and resultant processes.
2. Review isomeric transformation in gamma decay.

TOPIC: Lecture: **MIWIIIQII: 028606: "Photon Interaction in Matter"**

Objectives: **1.5 CEH**

1. Describe the interactions of charged particles with matter.
2. Describe the processes of excitation and ionization.
3. MIWIIIQII: EXAM III:

TOPIC: Lecture: **MIWIVQI: 028607: "Gaseous Detectors used in the PET Lab"**.

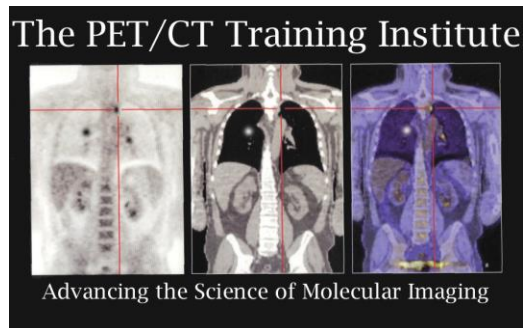
Objectives: **1.5 CEH**

1. Describe the construction and operating principles of gas filled detectors, ionization chambers, Geiger Mueller Detectors, and Dose Calibrators.
2. Explain the Dose Calibrator applications.
3. Explain quality control of the GM Survey Meter.
4. Describe Quality Control of the Dose Calibrator.

TOPIC: Lecture: **MIWIVQII: 028608: "Scintillation detectors used in nuclear medicine and PET"**.

Objectives: **1.5 CEH**

1. Describe the operations of scintillation detectors and photomultiplier tubes.
2. Discuss count rate limitations relative to dead time, efficiency, geometry and attenuation.
3. Describe basic design and properties of PET Scanners.
4. Explain the function of key components.
5. MIWIVQII: EXAM IV:



Module II: Radiation Safety

TOPIC: Lecture: **MIIWIQI: 028609: “The History of Radiobiology”**

Objectives:

1.5 CEH

1. Describe the Law of Bergonie and Tribondeau
2. Describe Fractionation Theory.
3. Describe Mutagenesis effects of radiation exposure.
4. Describe the Effects of Oxygen as a radio-sensitizer.
5. Describe Effects of Radiation on Reproductive system.

TOPIC: Lecture: **MIIWIQII: 028610: “Cellular Anatomy and Physiology”**

Objectives:

1.5 CEH

1. Indicate parts of the cell
2. Identify organic compounds and their functions
3. Identify inorganic compounds and their functions
4. Explain Mitosis
5. Explain Meiosis
6. MIIWIEI: EXAM I:

TOPIC: Lecture: **MIIWIIQI: 028611: “Cellular Effects of Radiation”**

Objectives:

1.5 CEH

1. Inspect the direct and indirect effects of radiation.
2. Evaluate the radiolysis of water.
3. Analyze the types of dose-response relationships.
4. Describe target theory.
5. Explain Cell survival curves.

TOPIC: Lecture: **MIIWIIQII: 028612**: “ **Effects of Initial Exposure to Radiation**”.

Objectives:

1.5 CEH

1. Describe hematological, gastrointestinal, and central nervous system syndromes.
2. Describe the local tissue damage to the skin, eyes and gonads.
3. Explain hematologic and cytogenetic effects.
4. MIIWIEII: EXAM II:

TOPIC: Lecture: **MIIWIIIQI: 028613**: “**Effects of Long-Term Exposure to Radiation**”.

Objectives:

1.5 CEH

1. Describe epidemiology.
2. Examine Risk Estimation Models.
3. Examine Radiation Induced malignancies.
4. Identify life span shortening.
5. Describe genetic damage.
6. Explain irradiation of the fetus.
7. Analyze stochastic and non-stochastic effects.

TOPIC: Lecture: **MIIWIIIQII: 028614**: “**Protection of Personnel**”

Objectives:

1.5 CEH

1. Describe the rationale for radiation protection.

2. Explain personnel dosimeters, dosimetry reports, and duties of the RSO.
3. Define and calculate the dose-limiting recommendations for PET/CT personnel.
4. Explain the basic structural shielding construction and list the items that influence this construction.
5. Describe how the PET/CT Technologist can decrease their radiation exposure during the patient preparation and scanning sequences.
6. Describe how using distance can decrease radiation exposure.
7. Illustrate the Inverse Square Law.
8. Identify garments that can be worn to reduce radiation exposure and explain how each garment should be used.
9. MIIWIIIIEIII: EXAM III:

TOPIC: Lecture: **MIIWIVQI: 028615: “Measuring Patient Dose from Computed Tomography Scanners”.**

Objectives:

1.5 CEH

1. Describe CT Scanner X-Ray Beam Geometry
2. Explain Methods of Measuring Patient Dose.
3. Describe Multiple Scan Average Dose curves.
4. Define CT Dose Index.
5. Measuring the CT Dose Index.
6. Describe Spiral/Helical CT Scanner Dosimetry.
7. Explain methods for reducing the patient dose from the CT Scanner.
8. Illustrate dosimetry survey of CT Scanners.

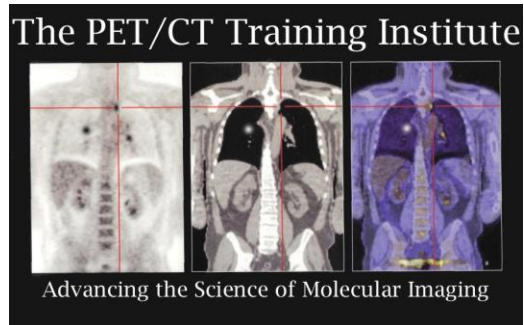
TOPIC: Lecture: **MIIWIVQII: 028616: Radiation Safety in PET Imaging**

Objectives:

1.5 CEH

1. List cautions signs and labels.
2. Describe the Do's and Don'ts in PET Radiation protection.

3. Examine the Receiving and Monitoring of Radioactive packages.
4. List the methods for Radioactive waste disposal.
5. Explain how to clean up a radioactive spill.
6. Describe recordkeeping principles.
7. MIIWIVEIV: EXAM IV



Module III: Instrumentation

TOPIC: Lecture: MIIWIFI: 028617: "CT Physics and Instrumentation".

Objectives:

1.5 CEH

1. Describe the physics of processes involved in the production of X-rays.
2. Describe the role of each component in the X-ray tube and its operation.
3. Describe the adjustment of X-ray tube voltage and mA current settings in CT.
4. Name the principal parts of the CT Scanner.
5. Describe the function of each CT Scanner component.
6. Describe how a Helical CT scanner operates and the component changes that made this technology possible.

Module III Week I Quiz II

TOPIC: Lecture: **MIIIWIQII: 028618: “Acquisition, Processing, and Display of CT Images”**.

Objectives

1.5 CEH

1. Describe how CT image data are acquired and processed.
2. Describe the calculation process of Hounsfield units.
3. Describe CT numbers values assigned to various tissues and how these values are assigned into meaningful display windowing.
4. List the parameters set by the operator for CT use and describe the effect of each on the images.
5. MIIIWIEI: EXAM I:

_ TOPIC: Lecture: **MIIIWIIQI: 028619: “Overview of CT Quality Control Procedures”**

Objectives:

1.5 CEH

1. Identifying the quality control parameter for QC measurements.
2. Describe the frequency of CT test requirements.
3. Examining the limits of a “Passing” Test.
4. Determining the Average CT Number of Water.
5. Evaluating the Standard Deviation of CT Number in Water.
6. Describe High Contrast Resolution testing in CT.
7. Evaluating a Low Contrast Resolution Phantom.
8. Determining the Accuracy of Distance Measuring Device.
9. Recognizing the Distortion of Video monitors.
10. Describe the Distortion of Film Images or Other Hard Copy Output.
11. Determining the causes of a Flat CT Number.
12. Evaluating the Hard Copy Output.
13. Describe the Accuracy of Localization Devices.
14. Describe the quality control procedure for Bed Indexing.

15. Determination of Light Field Accuracy.
16. Evaluation of Slice Width.
17. Describe CT Number versus Patient Position.
18. Explain CT Number versus Patient Size.
19. Describe CT Number versus Algorithm
20. Examine CT Number versus Slice Width
21. Identify Noise Characteristics.
22. Recognize Radiation Scatter and leakage.

TOPIC: Lecture: **MIIIIWIIQII: 028620: “An Overview of the Integration of CT Procedures into the combined PET/CT examination”**

Objectives:

1.5 CEH

1. Describe the use of Oral and IV Contrast Agents.
2. Describe the IV Pressure Injector for angiographic studies.
3. Evaluate the use of Timing Bolus's.
4. Review contrast agents adverse reactions.
5. MIIIIWIIIEII: EXAM II:

TOPIC: Lecture: **MIIIIWIIIIQI: 028621: “PET Instrumentation”**

Objectives:

1.5 CEH

1. List detector crystals that can be used for PET Imaging and describe their properties.
2. Explain the fundamental operation of dedicated and Hybrid PET Scanners and their design.
3. Describe the detection of True, Scatter, and random events.
4. Describe Transmission imaging and its need and use in attenuation corrected images.
5. Characterize the visual presentation of non-attenuated and attenuated corrected images.

TOPIC: Lecture: **MIIIWIIIQII: 028622: “Acquisition, Processing, and Display of PET Images”**.

Objectives:

1.5 CEH

1. Describe 2D and 3D acquisition protocols.
2. Describe scan protocol parameters.
3. Review Whole-Body versus Total Body acquisition modes.
4. Describe Dynamic Acquisition modes.
5. Define SUV and explain how it is calculated and used.
6. Describe critical elements in generating quantitative measurements.
7. Describe the process of data reconstruction.
8. Describe the implications of image fusion and describe the PET/CT Scanner.
9. MIIIWIIIQIII: EXAM III:

TOPIC: Lecture: **MIIIWIVQI: 028623: “An Overview of PET Quality Control Procedures”**.

Objectives:

1.5 CEH

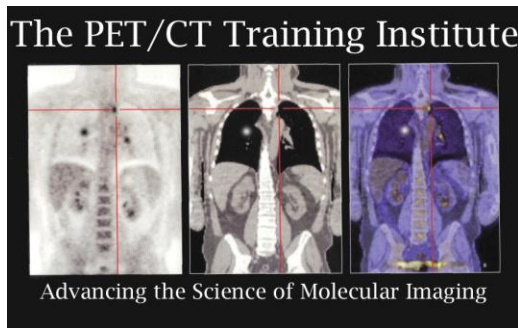
1. Describe the daily quality control procedures performed on a Hybrid PET/CT Scanner.
2. Describe the frequency of PET/CT Quality Control Procedures.
3. Analyze a typical Blank Scan.
4. Describe Blank Scans.
5. Describe Coincidence Timing Circuitry.
6. Describe Singles.
7. Describe Normalization
8. Describe Well Counter Calibration.

TOPIC: Lecture: **MIIIWIVQII: 028624: “Troubleshooting Image Artifacts in PET/CT”**.

Objectives:

1.5 CEH

1. Identify misregistration artifacts.
2. Review Patient Motion Artifacts.
3. Describe Beam Hardening Artifacts.
4. Identify Contrast Material Artifacts.
5. Describe Partial Volume Averaging Artifacts.
6. Review Equipment induced Artifacts.
7. Analyze Metal Artifacts.
8. Identify Ring Artifacts.
9. MIIWIVEIV: EXAM IV:



Module IV: Methodology

TOPIC: Lecture: **MIVWIFI: 028625: "Physics of Positrons and Production of PET Tracers"**.

Objectives:

1.5 CEH

1. Describe positron decay and the production of annihilation photons.
2. List positron emitting radionuclides and their properties.
3. Describe Generator produced versus Cyclotron produced radionuclides.
4. Describe the properties of Oxygen 15, Nitrogen 13, Carbon 11, and F-18.

TOPIC: Lecture: **MIVWIFI: 028626 "PET Radiopharmacy Quality Control"**

Objectives:

1.5 CEH

1. Describe Radionuclidic Purity.
2. Describe Radiochemical Purity.
3. Identify Chemical Impurities.
4. Describe Microbiological Sterility Testing.
5. Describe Pyrogen Testing .
6. Review the USP Quality Control requirements for F-18(FDG).
7. MIVWIEI: EXAM I:

TOPIC: Lecture: MIVWIIQI: 028627: "PET/CT Oncology"

Objectives:

1.5 CEH

1. Describe the principles of PET/CT FDG Oncology imaging.
2. Recognize the normal bio-distribution of FDG and list the organs with intense, moderate, or mild FDG activity.
3. Describe the normal patterns of head an neck FDG activity.
4. Describe the benign causes of increase FDG activity.
5. Describe the variations in FDG bio-distribution caused by improper patient preparation.
6. Describe the various cancers that localizes FDG.

TOPIC: Lecture: MIVWIIQII: 028628: PET/CT Oncology and Patient Preparation

Objectives:

1.5 CEH

1. Explain the steps in properly preparing a patient for a FDG PET Scan.
2. Describe the significance of peripheral blood glucose levels in FDG Imaging.
3. List the necessary historical information that should be obtained from each patient.
4. Describe patient positioning and comfort issues that can hinder the acquisition of a high quality scan.

5. Review Indications and contraindications of the whole body scan.
6. Describe PET/CT procedural parameters.
7. Review processing protocols.
8. Describe Normal and Abnormal case studies.
9. MIVWIIIEII: EXAM II:

TOPIC: Lecture: **MIVWIIIQI: 028629: "PET/CT Neurology"**

Objectives:

1.5 CEH

1. Describe radiopharmaceuticals used in Brain PET imaging.
2. Review the methods of localization of F-18(FDG) in Brain PET.
3. Describe contraindications associated with Brain PET scans.
4. Describe patient preparation for Brain scan.
5. Review the procedure for a Brain PET scan.
6. Describe patient history for a Brain PET scan.

TOPIC: **MIVWIIIQII: 028630: "Clinical Indications for Brain PET"**

Objectives:

1.5 CEH

1. Review procedures for Cerebrovascular Disease.
2. Describe Brain PET and Tumor imaging.
3. Review the procedures for diagnosing Epilepsy.
4. Describe Brain PET and Parkinson 's disease.
5. Describe diagnosing Dementia with PET.
6. Review Normal's and Abnormal case studies.
7. MIVWIIIIEIII: EXAM III:

_ TOPIC: Lecture: **MIVWIVQI: 028631: "PET/CT Cardiology"**

Objectives:

1.5 CEH

1. Describe various radiopharmaceuticals used for cardiac perfusion and viability imaging.
2. Describe the method of localization of the various radiopharmaceuticals.
3. Review the average patient doses.
4. Describe the methods for administering the radiopharmaceuticals.
5. Describe the Contraindications for cardiac PET.
6. Review the patient preparation procedures.
7. Describe the procedure for performing cardiac PET.
8. Describe pertinent patient histories associated with cardiac disease.

TOPIC: Lecture: **MIVWIVQII: 028632: "Clinical Indications for Cardiac PET"**

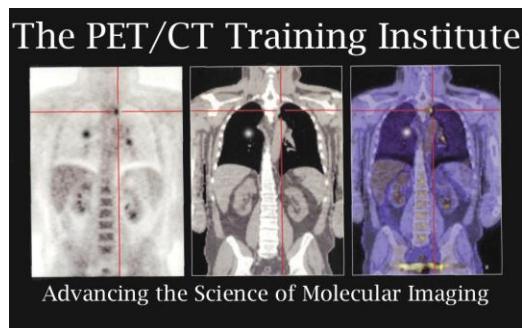
Objectives:

1.5 CEH

1. Evaluating tissue damage for myocardial ischemia.
2. Reviewing myocardial necrosis in cardiac PET.
3. Describe Normal and Abnormal case studies.
4. MIVWIVEIV: EXAM IV:

TOPIC: Post-Test

TOPIC: Course Evaluation



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